SECTION 02716 - CONCRETE SEWER STRUCTURAL SPOT REPAIR

City of San Diego, CWP Guidelines

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NTS: This Guide Specification addresses the use of the Linabond Structural Polymer System to repair surfaces in sewers and manholes which have damaged PVC lining and underlying concrete with seriously impaired structural integrity. There is no known equal at this time.

If the amount of area requiring spot repairs is not known precisely at the time of bidding, structure the bid for a unit price per square foot of repair liner applied, listing a reasonably accurate quantity estimate for bid evaluation purposes.

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PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing repairs to existing PVC liner in sewers [and manholes] at locations indicated on the Drawings. Repairs shall employ a structural polymer material and fully-adhered PVC sheet applied to prepared surfaces.

B. The WORK of this Section requires that materials and installation procedures be from Linabond, Inc. No substitutions will be considered.

1.2 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.3 REGULATORY REQUIREMENTS

A. The WORK of this Section shall comply with the current versions of the following:

1. Construction Safety Orders, Division of Industrial Safety, State of California.

2. California Department of Transportation Traffic Manual

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ASTM D 746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

ASTM C 805	Test Method for Rebound Number of Hardened Concrete
ASTM D 882	Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
ASTM D 1004	Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 2240	Standard Test Method for Rubber Property - Durometer Hardness
ASTM D 4258	Practice for Surface Cleaning Concrete for Coating
ASTM D 4259	Practice for Abrading Concrete
ASTM D 4262	Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. In addition to the shop drawings required by SSPWC Subsection 500-1.1.2, the following shall be submitted.

a. A written verification at least 2 days before commencing patching that the sewer [and manholes] is [are] free of obstructions and debris and is [are] in suitable condition for repairs.

b. Manufacturer's technical literature on the proposed repair system, including an affidavit attesting to the previous successful use of the material for lining sanitary sewers [and manholes].

2. Written certification from the manufacturer that the [CONTRACTOR] [proposed Subcontractor] is licensed by Linabond, Inc. to install the Structural Polymer System.

3. Copy of Linabond, Inc. certification for each individual who will apply the System.

4. Manufacturer's application instructions, including details of seams and terminations, Material Safety Data Sheets, maximum storage life and storage condition requirements, mixing and proportioning requirements, environmental requirements for worker safety such as ventilation, humidity, and temperature, thickness of activator, structural polymer, and seam material, and curing time requirements.

[5. Drawings and design calculations demonstrating adequacy of the proposed temporary working platforms. For the purpose of calculations, assume a wastewater velocity of 6 ft per second and the pipe is flowing full.]

[6. Describe the means and time required to remove a platform system in an emergency.]

1.6 INSTALLER QUALIFICATIONS

A. The CONTRACTOR or subcontractor performing the WORK of this section shall be licensed by the repair system manufacturer. Each individual installing the repair material shall be certified by the manufacturer.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Repair shall be made with a fully adhered structural polymer and polyvinyl chloride (PVC) sheet applied to prepared surfaces of existing concrete and PVC liner. Repairs shall be leakproof under a minimum external hydrostatic pressure of 15 feet of water above the top of the pipe.

B. Applications of the repair material shall be performed under the supervision of a technical representative of the manufacturer who shall be present at the site during repair operations.

2.2 MATERIALS

A. **Structural Polymer:** Structural polymer shall be a plural-component, closed-cell polyurethane type, resistant to weathering, aging, 10 percent solutions of sulfuric acid, and intermittent wetting by raw sewage.

B. **PVC Sheet Liner:** Polyvinyl chloride lining material shall be a 30 mil thick homogenous thermoplastic sheet recommended by the manufacturer of the structural polymer. Liner shall conform to SSPWC Subsection 210-2 except that paragraphs 210-2.4.2 and 210-2.4.4 shall not apply.

1. Instead of the properties in Table 210-2.2(A), the PVC sheet shall have the following properties:

Property	Standard	Initial Requirement	After Exposure
Specific gravity	ASTM D 792	1.33	1.20
Hardness, Shore A	ASTM D 2240	84	--
Tensile Strength	ASTM D 882	2300 psi	2070 psi
Elongation	ASTM D 882	300 percent	270 percent
Brittle Point, ModE	ASTM D 746	-30 degrees C	--
Tear Strength	ASTM D 1004	250 ppi	225 ppi
Color		White	--

C. **Surface Activator:** Surface activator shall provide cross linking with the PVC sheet liner and the structural polymer. Surface activator shall be as required by the manufacturer.

D. **Seam Material:** Seam material shall retain the chemical and adhesive properties of the structural polymer while permitting relatively flat, smooth laps between adjacent PVC sheets. Seam material shall be as required by the manufacturer.

E. **Chemical Resistance:** The PVC sheet liner, sealant material, and surface activator shall act as a cured seam through molecular bonding and shall conform to the chemical resistance test requirements of SSPWC subsection 210-2.3.3 for chemical solutions at listed concentrations. SSPWC subsection 210-2.3.4 shall not apply: the criteria above shall apply.

F. **Hydraulic Plug:** Quick-setting material recommended by the manufacturer for sealing active leaks into sewers. Material shall be compatible with structural polymer.

PART 3 -- EXECUTION

3.1 PRODUCT, DELIVERY, STORAGE, AND HANDLING

A. Materials shall be shipped in original manufacturer's containers and such additional packaging as needed to protect the material from damage during transport. Containers shall be plainly labeled to show manufacturer's name, product name, batch number, date of manufacture, quantity of contents, and storage requirements.

B. Stored materials shall be protected from excessive heat, cold, and weathering. PVC sheeting pretreated with activator prior to delivery to the job site shall be protected from debris contamination and be maintained at 70 degrees F minimum.

3.2 WORKING CONDITIONS

A. The CONTRACTOR is hereby notified that the sewer is a permit required confined space.

B. Wastewater will continue to flow through the sewer during liner repair, and the CONTRACTOR shall be prepared to perform liner repair during prevailing flow conditions in the sewer [using working platforms as indicated below] or to divert the sewage as indicated below. Liner repair operations shall not be performed if weather conditions are such that anticipated wastewater flows can exceed diversion pumping capacity or depths that prevent proper and safe work within the sewer. Liner repair operations shall be conducted only when the sewage level in the pipe is at a minimal depth.

C. The CONTRACTOR shall employ means and methods which prevent blockage and minimize surcharge of wastewater in upstream manholes and tributary pipelines.

3.3 DIVERSION PUMPING

A. Install and operate diversion pumping equipment to maintain sewage flow and to prevent backup or overflow upstream.

B. Design all piping, joints, and accessories to withstand twice the maximum system pressure or 50 psi, whichever is greater. A spare pump and piping shall be at the site, ready for use in case of a breakdown.

C. In the event of accidental spill or overflow, immediately stop the overflow and take action to clean up spillage and disinfect the spill area to the satisfaction of the CONSTRUCTION MANAGER.

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NTS: If the sewer to be repaired is 48 inches in diameter or larger, include the working platform-related requirements which are at several locations in this section.

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[3.4 WORKING PLATFORMS

A. The CONTRACTOR shall provide temporary working platforms for repairs located above the springline of the pipe. Platforms shall be designed to withstand the hydraulic forces created by sewage flow. Platforms shall be sized and located to collect falling debris larger than 1/2-inch from [cleaning and] hydroblasting operations.

B. Platforms may be anchored to the pipeline, but all holes and penetrations of the existing PVC liner shall be repaired according to this section.]

3.5 CLEANING AND SURFACE PREPARATION

A. Cleaning and Debris Removal

1. Prior to blasting the concrete surfaces and installing the new liner systems, the CONTRACTOR shall clean the interior of the pipeline by removing all accumulated debris and disposing of it in compliance with all Federal, State and local regulations. Debris includes sludge, dirt, sand, rocks, grease, roots, and other solid or semi solid materials.

2. Remove defective PVC liner from the entire damaged area plus 2 inches in all directions.

3. The CONTRACTOR shall employ suitable equipment to collect all debris dislodged during cleaning operations. At a minimum, debris shall be removed prior to the end of each day and shall be disposed of daily at an approved off-site location. Hauling containers shall be watertight.

4. Active leaks, if present, shall be sealed by application of hydraulic plug material.

B. **Surface Preparation:** The CONTRACTOR may choose any of the surface preparation methods below that will produce a clean, contamination-free, sound, roughened surface acceptable to the manufacturer's representative. Exposed reinforcing steel shall be cleaned to white metal blast condition (SSPC-SP5) and coated immediately with 40 miles of **Sikatop 110 Armatec by Sika Corporation**.

1. Wet Abrasive Blast: Water and blast material at 80 psi or greater at the nozzle. Abrasive shall be free of arsenic and free silica. Residue shall be removed by washing with water and brushing if necessary.

2. Hydroblast: Water pressurized to at least 6000 psi.

3. Dry Sandblasting: Air and blast material at 80 psi or greater at the nozzle. Abrasive shall be free of arsenic and free silica. Residue shall be removed by brushing, vacuuming, or oil-free compressed air.

3.6 SURFACE TESTING

A. The surface of the abraded concrete shall be tested for soundness by the use of an impact rebound testing device (Schmidt hammer) with a measurement accuracy of plus or minus 500 psi, in accordance with ASTM C 805. Testing shall be performed by the CONTRACTOR in the presence of the manufacturer's representative and the CONSTRUCTION MANAGER. Abraded concrete shall indicate a compressive strength of 3000 psi or further surface preparation shall be undertaken.

B. The pH of the abraded surface shall be tested according to ASTM D 4262. The acceptable pH range for the prepared surface shall be greater than 7 and less than 11 unless the manufacturer representative accepts otherwise. Surfaces with pH less than 7.0 shall be reblasted and retested until the pH is in the acceptable range. All testing shall be performed by the CONTRACTOR in the presence of the manufacturer's representative and the CONSTRUCTION MANAGER.

C. The manufacturer's representative shall inspect the prepared surfaces and observe the surface testing above and approve surface conditions before repairs begin.

3.7 REPAIR

A. Repair and surface preparation operations shall be separated sufficiently that contamination with abrasive does not occur.

B. Prior to application of the structural polymer and PVC liner, the surface of the prepared concrete and adjacent liner shall be surface dry. Surface dry is defined as a surface where there is no visible water beading, dripping, or running. Surfaces contaminated by sewage or debris shall be cleaned and dried before application of the lining system. The CONTRACTOR shall be responsible for methods and equipment to achieve a dry surface condition. If compressed air equipment is utilized, it shall be equipped with an oil filter.

C. Existing PVC liner shall be solvent-cleaned to remove grease and oil for a minimum of 6 inches in all directions from an area which will be repaired.

D. Areas deteriorated to the degree that an uneven, unsightly lined surface will result, shall be repaired before application of structural polymer with a polymer cement patching compound acceptable to the repair system manufacturer.

E. Patch

1. Proportioning and Mixing: Materials shall be mixed and proportioned in accordance with the manufacturer's written instructions using the equipment recommended by the manufacturer.

2. Structural Polymer

a. Structural polymer shall only be applied to a clean, prepared and dry, sound concrete surface. Structural polymer shall cover all exposed aggregate and surfaces of exposed reinforcing steel, providing a smooth surface for application of the PVC liner. Structural polymer shall provide a minimum 1/8-inch thick cover over the surface of the exposed concrete aggregate material and 3/4-inch over exposed reinforcing steel prior to application of the PVC sheets.

b. Application of PVC liner after spraying of the structural polymer shall be in accordance with manufacturer's installation instructions. In no event shall the PVC liner be applied later than 45 minutes after application of the structural polymer, or the area shall be resprayed and allowed to tack again.

3. Activator: The CONTRACTOR may use preactivated sheets or apply activator at the site. Apply activator to clean, dry PVC sheets in accordance with manufacturer's instructions. Allow to dry "tack-free" prior to applying sheet. Activator shall be applied to sheets in a warm (70 degree F minimum), protected environment. Protect prepared sheet from debris contamination. Do not exceed the manufacturer's recommended

elapsed time between application of activator to sheet and application of sheet to structural polymer.

4. Sheet Liner

   a. New liner shall be applied over existing liner and over prepared concrete so that either new or old liner cover the top [270] degrees around the pipe circumference, covering the crown and both sides of the pipe but not the lowest [90] degrees of the invert.

   b. Seams between new sheets of liner shall overlap a minimum of 4 inches in the downstream direction of wastewater flow. Apply seam material as recommended by the manufacturer.

   c. The activator-prepared surface of the new PVC sheet shall be pressed onto the tacky structural polymer and seam material and be rolled carefully to remove trapped air.

   d. Apply support to PVC sheet on the sewer crown by forms and jacks furnished by the repair system manufacturer.

5. **Sheet Liner Terminations:** Where the new lining meets the existing lining, the new liner shall overlap the existing liner by a minimum of four inches. Termination of new liner on concrete at upstream, downstream, top, and bottom edges shall be in accordance with the shop drawings and the manufacturer's recommendations.

3.8 FIELD TESTING

A. The liner will be inspected by the CONSTRUCTION MANAGER for proper adhesion, air pockets, edges or seam defects, rips, tears, and punctures. Defective repairs shall be removed, replaced, and retested.

B. The newly applied PVC liner shall be spark tested and any lining failing to meet the spark test shall be properly repaired and retested. The spark testing shall be done with a Tinker and Rasor Holiday Detector set at 20,000 volts.

C. Areas failing the spark test shall be repaired by trimming, application of new structural polymer or seam material, as determined by the manufacturer's representative, and activated PVC sheet, overlapping the acceptable repairs at least 4 inches all around.

[3.9 TELEVISION INSPECTION

A. Sewer [and manholes] shall be inspected by closed circuit television (CCTV) to document the condition of repaired PVC liner in accordance with Section 02735.]

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